In yet another respect, disclosed is a method of managing I/O resources in an information delivery environment, including modeling utilization of at least one of the I/O resources; and managing at least one of the I/O resources based at least in part on the modeled utilization.

5   In yet another respect, disclosed is a method of managing I/O resources for delivery of continuous media data to a plurality of viewers from a storage system including at least one storage device or at least one partitioned group of storage devices, the method including modeling utilization of at least one of the I/O resources; and managing at least one of the I/O resources based at least in part on the modeled utilization.

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In yet another respect, disclosed is a method of managing I/O resources in an information delivery environment, including performing admission control and determining read-ahead size for a storage system based at least in part on modeled utilization of at least one I/O resources of the storage system.

15   In yet another respect, disclosed is a method of modeling utilization of one or more I/O resources in an information delivery environment, including monitoring at least one of the system I/O performance characteristics associated with the I/O resources, and modeling utilization of at least one of the I/O resources based at least in part on the monitored I/O system

20   performance characteristics.

In yet another respect, disclosed is a method of monitoring I/O resource utilization in an information delivery environment, including monitoring the I/O resource utilization at the logical volume level.

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In yet another respect, disclosed is a method of monitoring I/O resource utilization for delivery of information to a plurality of viewers from an information management system including storage system I/O resources and at least one storage device or at least one partitioned group of storage devices; the method including logically monitoring workload of the at least one

30   storage device or at least one partitioned group of storage devices.

In yet another respect, disclosed is an I/O resource management system capable of managing I/O resources in an information delivery environment, including: an I/O resource model capable of modeling utilization of at least one of the I/O resources; and an I/O resource manager in communication with the I/O resource model, the I/O resource manager being capable of managing at least one of the I/O resources based at least in part on the modeled utilization.

In yet another respect, disclosed is an I/O resource management system capable of managing I/O resources for delivery of continuous media data to a plurality of viewers from a storage system including at least one storage device or at least one partitioned group of storage devices, the system including: an I/O resource monitor, the I/O resource monitor being capable of monitoring at least one of the system I/O performance characteristics associated with the I/O resources; an I/O resource model in communication with the I/O resource monitor, the resource model being capable of modeling utilization of at least one of the I/O resources based at least in part on the at least one of the monitored system I/O performance characteristics; and an I/O resource manager in communication with the I/O resource model, the I/O resource manager being capable of managing at least one of the I/O resources based at least in part on the modeled utilization.

In yet another respect, disclosed is an information delivery storage system, the storage system including: a storage management processing engine that includes an I/O resource manager, a logical volume manager, and a monitoring agent; the I/O resource manager, the logical volume manager, and the monitoring agent being in communication; and at least one storage device or group of storage devices coupled to the storage management processing engine; wherein the information delivery storage system includes part of an information management system configured to be coupled to a network.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified representation of a storage system including a storage management processing engine coupled to storage devices according to one embodiment of the disclosed methods and systems.

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FIG. 2 is a graphical representation of buffer allocation and disposition versus time for a sliding window buffer approach using two buffers according to one embodiment of the disclosed methods and systems.

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FIG. 3A illustrates deterministic I/O resource management according to one embodiment of the disclosed methods and systems.

FIG. 3B illustrates deterministic I/O resource management according to another embodiment of the disclosed methods and systems.

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FIG. 4A is a simplified representation of a storage system including a storage processor capable of monitoring workload of storage devices coupled to the storage system according to one embodiment of the disclosed methods and systems.

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FIG. 4B is a simplified representation of a storage system having multiple storage devices that are allocated portions of buffer memory according to one embodiment of the disclosed methods and systems.

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FIG. 5 illustrates lower and upper bounds of cycle time T plotted as a function of total number of viewers NoV according to one embodiment of the disclosed methods and systems.

FIG. 6 illustrates lower and upper bounds of cycle time T plotted as a function of total number of viewers NoV according to one embodiment of the disclosed methods and systems.

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FIG. 7 illustrates lower and upper bounds of cycle time T plotted as a function of total number of viewers NoV according to one embodiment of the disclosed methods and systems.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

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